

COMPARATIVE STUDY OF INTRAOCULAR PRESSURE CHANGES WITH LARYNGEAL MASK AIRWAY AND ENDOTRACHEAL TUBE

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ABSTRACT

Aims: To evaluate the intraocular pressure changes subsequent to insertion and removal of laryngeal mask airway and endotracheal tube.

Methods: The study was conducted in 60 adult patients. A standard general anaesthesia was administered to all patients, after induction of anaesthesia baseline measurements of intraocular pressure was taken, following which patients were divided into two groups. In group-I, airway secured with endotracheal tube and in group -II, with the laryngeal mask airway. Intraocular pressure measurements were done after induction and repeated immediately, three and six minutes after intubation with endotracheal tube or laryngeal mask airway insertion. At the end of surgery, intraocular pressure was measured again, immediately after reversal and three minutes after removal of endotracheal tube or laryngeal mask airway. The intraocular pressure measured after induction of anaesthesia was compared with intraocular pressure values in two groups at different intervals.

Results: A statistically significant increase in intraocular pressure was seen in group-I (ETT) as compared to group- II (LMA) ($p < 0.001$) immediately after securing airway and also at the end of surgery immediately after reversal and three minutes after removal of endotracheal tube or laryngeal mask airway.

Conclusion: Use of laryngeal mask airway might offer advantages in patients where minimal changes in intraocular pressure are desirable.

Key words: Endotracheal tube, laryngeal mask airway, intraocular pressure

INTRODUCTION

Anaesthetic management plays an important role in the successful outcome of operation on the eye. Tracheal intubation is the commonest method of securing definitive airway for administering anaesthesia. Intubation is associated with tachycardia, hypertension and increase in intraocular pressure.^{1,2,3} Prevention of rise in intraocular pressure is of utmost importance in conditions like open eye surgery glaucoma and strabismus, particularly in intraocular surgery. Attempts must be made to maintain intraocular tension at or below normal levels.⁴ The stress response to tracheal intubation and extubation is associated with rise in intraocular pressure mainly due to increased sympathetic stimulation.^{3,5} Increase in

intraocular pressure may not have any adverse effect in patients with healthy eyes but has deleterious effects on a diseased or an injured eye.

Various pharmacological and non-pharmacological methods have been tried to limit the presser responses and intraocular pressure changes following endotracheal intubation. Brain's laryngeal mask airway has gained worldwide acceptance and is now considered as one of the essential equipment for airway management.^{6,7} Laryngeal mask airway insertion is easy with no or minimal trauma to the larynx and to the pharynx, no tracheal stimulation and a less severe haemodynamic and ocular stress response on insertion as compared to laryngoscopy, tracheal intubation

and extubation.⁸ The present study was conducted to assess the intraocular pressure changes to the insertion of laryngeal mask airway in non ophthalmic surgery and compared these changes to endotracheal intubation during induction and at the end of surgery.

MATERIAL AND METHODS

After approval by ethical committee and informed consent from patients, the study was carried out on sixty ASA grade I patients of either sex, aged between twenty to sixty years, taken up for elective non-ophthalmic surgeries were divided into two small fixed and equal size groups (n=30 each group) by simple random sampling. Patients with history of glaucoma, hypertension, diabetes mellitus, acid-peptic disease and obesity were excluded. All patients were pre-operatively assessed and investigated.

The patients were premedicated with injection atropine 0.5 mg, injection pethidine 1.5 mg/kg intramuscularly thirty minutes before surgical procedure. Monitoring comprised of electrocardiogram, non-invasive blood pressure and oxygen saturation. All patients were preoxygenated for three minutes and anaesthesia was induced with injection pancuronium 0.1 mg/kg of body weight followed by injection sodium thiopentone (2.5%) 4 to 6 mg/kg. Patients were ventilated with 100% oxygen using intermittent positive pressure ventilation for three minutes. Intraocular pressure was measured in both eyes using schiotz tonometer after instilling two drops of 4% lidocaine in each eye and the average of intraocular pressure in the two eyes was taken as reading. After induction patients were randomly allocated in to either of the following groups of thirty patients each.

GROUP-I direct laryngoscopy and endotracheal intubation was done with appropriate size of red rubber cuff oral endotracheal tube lubricated with 2% lignocaine jelly.

GROUP-II appropriate size of laryngeal mask airway lubricated with 2% lignocaine jelly was inserted blindly. Satisfactorily placement of airway device was confirmed by auscultation of chest during gentle positive pressure ventilation.

Intraocular pressure measurement was done immediately after induction of anaesthesia, after

endotracheal intubation or laryngeal mask airway insertion, three minutes and six minutes after previous readings. Anaesthesia was maintained with 66% nitrous oxide in oxygen pancuronium and 0.5% Halothane.

Pulse and blood pressure were monitored every fifteen minutes in all the patients perioperatively. At the end of surgery all the patients were reversed with injection neostigmine 0.05mg/kg and injection Atropine 0.02 mg/kg intravenously. Intraocular pressure was measured immediately after reversal and three minutes after extubation or removal of laryngeal mask airway. Soframycin eye drops were instilled in the patient's eyes during the recovery period to prevent infection.

OBSERVATIONS AND RESULTS

The two airway groups were comparable with respect to weight, age sex and surgical procedures.

Comparing the changes in intraocular pressure at different interval in group - I and group - II, the basal value measured after induction was similar in both groups (Table 1). The rise in intraocular pressure immediately after intubation in group-I and rise in intraocular pressure immediately after Insertion of laryngeal mask airway in group-II was significantly different (Table 1)

Though, the intraocular pressure increased both after endotracheal intubation and laryngeal mask airway insertion there was difference in the degree of rise in intraocular pressure in two groups, which was highly significant ($p < 0.001$) (Table 2). After endotracheal intubation, the intraocular pressure roused to a mean value of 16.8 ± 1.71 mm of Hg, whereas, after laryngeal mask airway insertion mean intraocular pressure was only 12.8 ± 1.74 mm of Hg. Within three minutes of insertion of endotracheal tube or laryngeal mask airway the intraocular pressure was decreased but the difference between two groups was highly significant (Table 2). In group -I, though there was fall, the value remained higher than basal value whereas in group -II it decreased below the basal value. The fall in intraocular pressure within six minutes after intubation in group-I and laryngeal mask airway insertion in group-II was significantly different in two groups ($p < 0.001$) (Table 2).

Table 1: Intraocular pressure changes at different stages of general anaesthesia in ETT and LMA groups

	MEAN±S.D. (mm of Hg)	Tcal	d.f	PVALUE	% Change
Group-I ETT (N=30)					
AfterInduction (basal value)	12.3±1.89	-	-		
After Insertion ofETT/LMA	16.8±1.71	16.68	29	<0.001	36.59 ↑
3 minutes afterInsertion ofETT/LMA	14.3±0.04	4.09	29	<0.001	16.26↑
6 minutes after InsertionofETT/LMA	11.8±0.03	2.143	29	> 0.05	4.07 ↑
After reversal	18.9±1.07	12.654	29	<0.001	53.66 ↑
3 minutes after removal of ETT/LMA	16.0±1.72	7.349	29	<0.001	30.08 ↑
Group-II LMA (N=30)					
AfterInduction (basal value)	12.3±1.6	-	-		
After Insertion ofETT/LMA	12.8±1.74	2.005	29	<0.05	4.07↑
3 minutes afterInsertion ofETT/LMA	11.2±1.4	4.206	29	>0.05	8.94↓
6 minutes after InsertionofETT/LMA	10.4±0.04	5.409	29	>0.05	15.45↓
After reversal	13.7±1.08	4.007	29	<0.01	11.38↑
3 minutes after removal of ETT/LMA	10.4±0.03	6.032	29	<0.01	15.45↓

ETT : Endotracheal tubeLMA : Laryngeal mask airway

*paired 't' testapplied ,(p< 0.05 - significant)

Table 2: Comparison of Intraocular Pressure Changes between ETT and LMA Groups at Different Stages of General Anaesthesia

	Group-I ETT (N=30)		Group-II LMA (N=30)		t value	df	P Value
	Mean±SD#	% Change	Mean±SD#	% Change			
AfterInduction (basal value)	12.3±1.89		12.3±1.6		-	-	
After Insertion ofETT/LMA	16.8±1.71	36.59 ↑	12.8±1.74	4.07↑	10.088	58	<0.001
3 minutes afterInsertion of ETT/LMA	14.3±0.04	16.26↑	11.2±1.4	8.94↓	9.476	58	<0.001
6 minutes after Insertion of ETT/LMA	11.8±0.03	4.07 ↑	10.4±0.04	15.45↓	5.340	58	<0.001
After reversal	18.9±1.07	53.66 ↑	13.7±1.08	11.38↑	11.427	58	<0.001
3 minutes after removal of ETT/LMA	16.0±1.72	30.08 ↑	10.4±0.03	15.45↓	13.819	58	<0.001

*Unpaired 't' test applied, #mm of Hg

There was increase in intraocular pressure immediately after reversal both in group-I and group-II but the rise in group -II was less as compared to that in group-I and difference was highly significant (p<0.001). After three minutes of extubation intraocular pressure increased in group -I, whereas in group-II there was a fall in intraocular pressure below the basal value . The difference of values in two groups was statistically significant (p<0.001) (Table 2).

DISCUSSION

Any increase in ocular vascular congestion during intraocular surgery is undesirable and

possibly dangerous and should be avoided in order to safeguard against expulsion of vitreous humor from the open eye . Therefore ideal technique for intraocular pressure should produce a moderate reduction in intraocular pressure at near normal values and avoid marked fluctuations during surgery.

Benjamin et al⁹ reported that Laryngoscopy and tracheal intubation causes transient increase in intraocular pressure. It has been suggested that endotracheal intubation generally cause autonomic reflex response such as tachycardia, hypertension and a rise in intraocular pressure. Holden R.¹⁰ in 1991 tried to mitigate this

response by using laryngeal mask airway as an alternative to endotracheal tube.

In the present study rise in intraocular pressure was highly significant ($p < 0.001$) in endotracheal tube group, immediately after intubation, which started decreasing within three minutes after intubation and fell below the basal value within six minutes of intubation and this fall was insignificant ($p > 0.05$). In comparison, in laryngeal mask airway group, it showed a smaller but significant ($p < 0.05$) increase in intraocular pressure immediately after insertion of laryngeal mask airway and gradual decrease in intraocular pressure below the basal value within three minutes of insertion.

Similar observation was made by Lamb K et al², Chawla and colleague¹ and Ghai B et al⁵, who reported a significant rise in intraocular pressure immediately after endotracheal intubation and an insignificant rise after laryngeal mask airway insertion. In a similar study, Akhtar TM et al¹¹ did not observe any difference in intraocular pressure in two groups.

Adrenergic stimulation may cause vasoconstriction and an increase in central venous pressure which has a closer relationship to intraocular pressure than systemic pressure¹². It can produce an acute increase in intraocular pressure by increasing the resistance to the outflow of aqueous humor in the trabecular meshwork between the anterior chamber and the Schlemm's canal.¹³ At the end of surgery, before extubation intraocular pressure was significantly greater in endotracheal tube group than in laryngeal mask airway group and extubation was followed by further increase in intraocular pressure in endotracheal tube group.

The difference between two groups in magnitude of the rise of Intra ocular pressure near the end of surgery might be due to lightening of anaesthesia, resulting in stimulation of sympathetic pathway by the presence of endotracheal tube in group- I, but not in group-II because of better tolerance of the laryngeal mask airway at this depth of anaesthesia.

It is concluded from our study that laryngeal mask airway insertion is a suitable alternative to endotracheal intubation in patients having

penetrating eye injuries, glaucoma and strabismus in whom elevation of intraocular pressure is likely to be detrimental.

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